INTEGRATED CIRCUITS

DATA SHEET

TDA7021T
FM radio circuit for MTS

Product specification
File under Integrated Circuits, IC01

May 1992





GENERAL DESCRIPTION

The TDA7021T integrated radio receiver circuit is for portable radios, stereo as well as mono, where a minimum of periphery is important in terms of small dimensions and low cost. It is fully compatible for applications using the low-voltage micro tuning system (MTS). The IC has a frequency locked loop (FLL) system with an intermediate frequency of 76 kHz. The selectivity is obtained by active RC filters. The only function to be tuned is the resonant frequency of the oscillator. Interstation noise as well as noise from receiving weak signals is reduced by a correlation mute system.

Special precautions have been taken to meet local oscillator radiation requirements. Because of the low intermediate frequency, low pass filtering of the MUX signal is required to avoid noise when receiving stereo. 50 kHz roll-off compensation, needed because of the low pass characteristic of the FLL, is performed by the integrated LF amplifier. For mono application this amplifier can be used to directly drive an earphone. The field-strength detector enables field-strength dependent channel separation control.

Features

- RF input stage
- Mixer
- Local oscillator
- IF amplifier/limiter
- Frequency detector
- Mute circuit
- MTS compatible
- Loop amplifier
- Internal reference circuit
- LF amplifier for
  - mono earphone amplifier or
  - MUX filter
- Field-strength dependent channel separation control facility

QUICK REFERENCE DATA

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage (pin 4)		$V_P = V_{4-3}$	1,8	–	6,0	V
Supply current	V_P = 3 V	I_4	–	6,3	–	mA
RF input frequency		f_{rf}	1,5	–	110	MHz
Sensitivity (e.m.f.) for –3 dB limiting	source impedance = 75 Ω; mute disabled	EMF	–	4	–	µV
Signal handling (e.m.f.)	source impedance = 75 Ω	EMF	–	200	–	mV
AF output voltage		V_o	–	90	–	mV

PACKAGE OUTLINE

16-lead mini-pack; plastic (SO 16; SOT109A); SOT109-1; 1996 July 24.

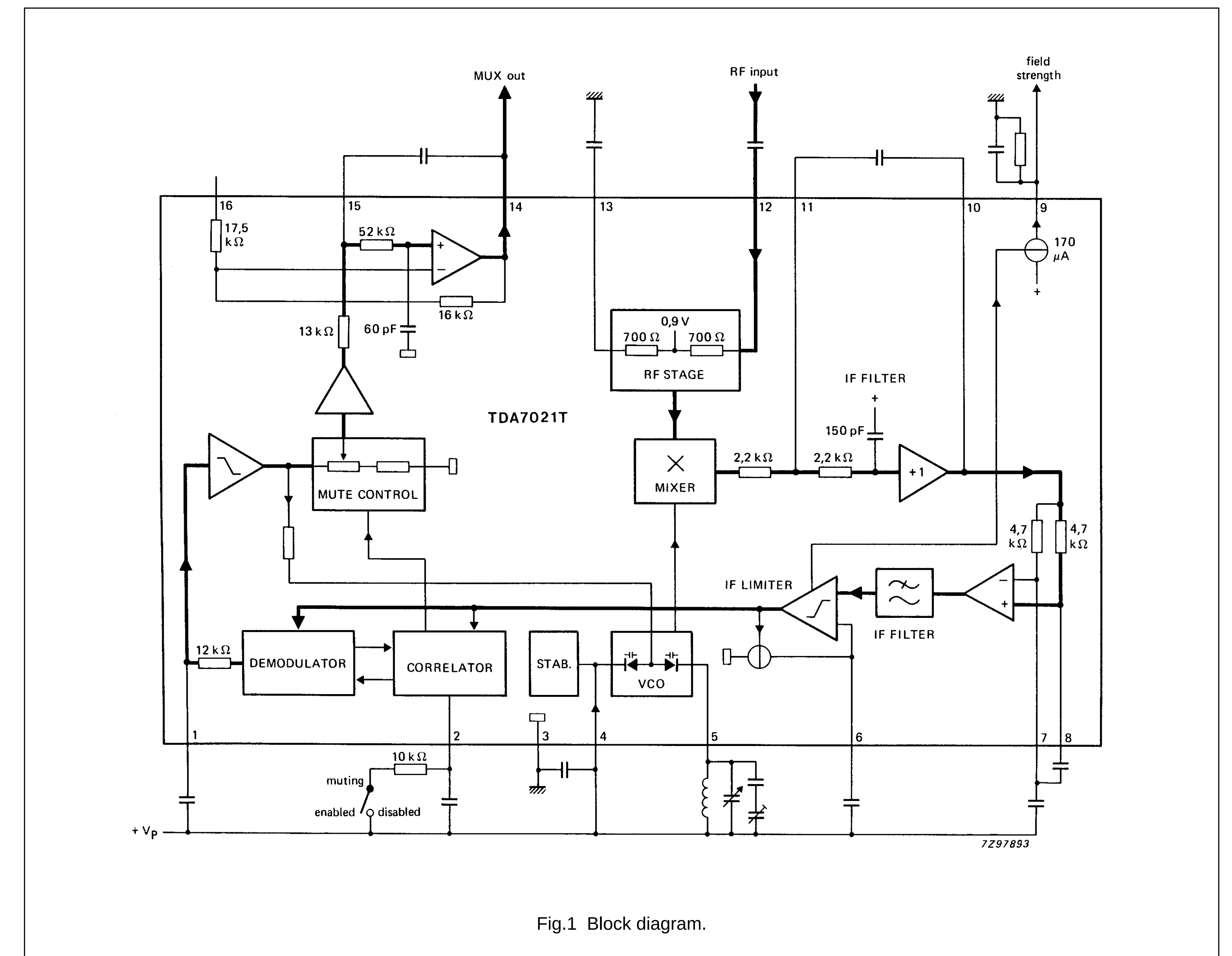


Fig.1 Block diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

PARAMETER	CONDITIONS	SYMBOL	MIN.	MAX.	UNIT
Supply voltage (pin 4)		$V_P = V_{4\text{-}3}$	–	7,0	V
Oscillator voltage		$V_{5\text{-}4}$	V_P–0,5	V_P + 0,5	V
Storage temperature range		T_{stg}	–55	+150	°C
Operating ambient temperature range		T_{amb}	–10	+70	°C

THERMAL RESISTANCE

From junction to ambient $R_{th\ j\text{-}a}$ 300 K/W

DC CHARACTERISTICS

V_P = 3 V, T_{amb} = 25 °C, measured in circuit of Fig.4, unless otherwise specified

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage (pin 4)		$V_P = V_{4\text{-}3}$	1,8	3,0	6,0	V
Supply current	V_P = 3 V	I_4	–	6,3	–	mA
Oscillator current		I_5	–	250	–	µA
Voltage at pin 13		$V_{13\text{-}3}$	–	0,9	–	V
Output voltage (pin 14)		$V_{14\text{-}3}$	–	1,3	–	V

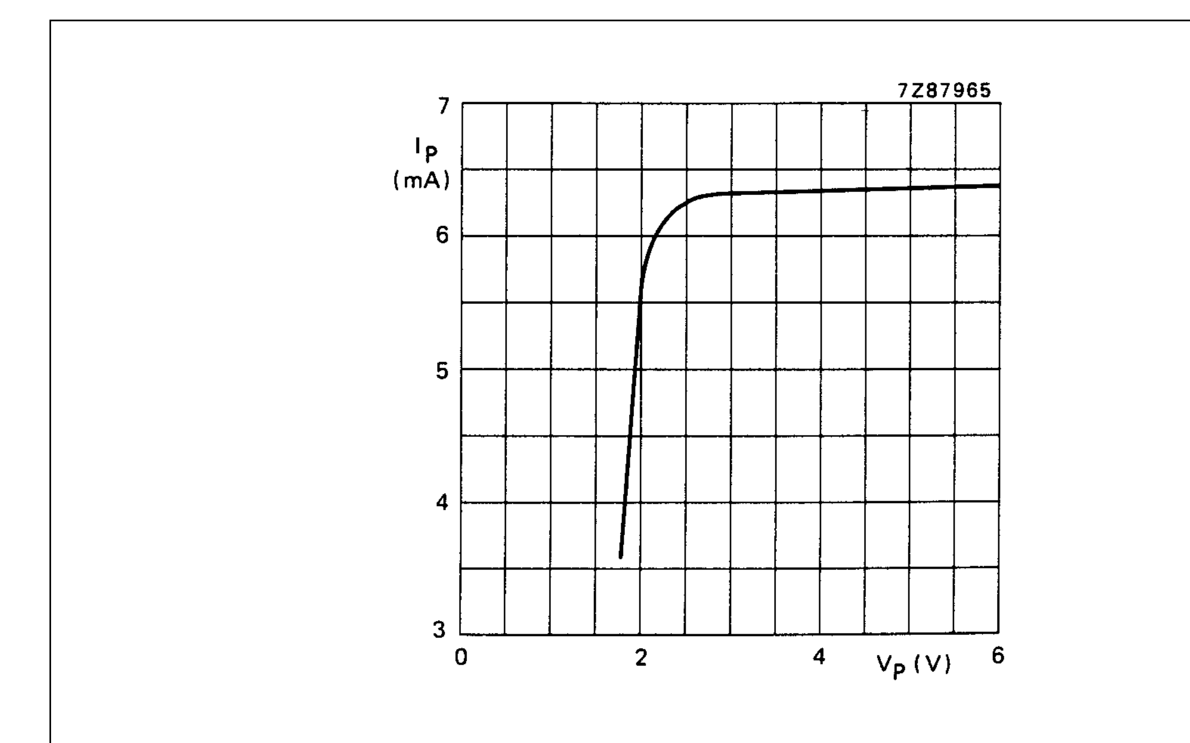


Fig.2 Supply current as a function of the supply voltage.

AC CHARACTERISTICS (MONO OPERATION)

V_P = 3 V; T_{amb} = 25 °C; measured in Fig.5; f_{rf} = 96 MHz modulated with Δf = ±22,5 kHz; f_m = 1 kHz; EMF = 0,3 mV (e.m.f. at a source impedance of 75 Ω); r.m.s. noise voltage measured unweighted (f = 300 Hz to 20 kHz); unless otherwise specified

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Sensitivity (e.m.f.)	see Fig.3					
for –3 dB limiting	muting disabled	EMF	–	4,0	–	μV
for –3 dB muting		EMF	–	5,0	–	μV
for (S+N)/N = 26 dB		EMF	–	7,0	–	μV
Signal handling (e.m.f.)	THD < 10%; Δf = ± 75 kHz	EMF	–	200	–	mV
Signal-to-noise ratio		(S+N)/N	–	60	–	dB
Total harmonic distortion	Δf = ± 22,5 kHz	THD	–	0,7	–	%
	Δf = ± 75 kHz	THD	–	2,3	–	%
AM suppression of output voltage	ratio of AM signal (f_m = 1 kHz; m = 80%) to FM signal (f_m = 1 kHz; Δf = 75 kHz)	AMS	–	50	–	dB
Ripple rejection	ΔV_P = 100 mV; f = 1 kHz	RR	–	30	–	dB
Oscillator voltage (r.m.s. value)		$V_{5\text{-}4(rms)}$	–	250	–	mV
Variation of oscillator frequency with temperature	V_P = 1 V	$\frac{\Delta f_{osc}}{\Delta T_{amb}}$	–	5	–	kHz/°C
Selectivity	see Fig.9; no modulation	S_{+300}	–	46	–	dB
		S_{-300}	–	30	–	dB
AFC range		$\pm\Delta f_{rf}$	–	160	–	kHz
Mute range		$\pm\Delta f_{rf}$	–	120	–	kHz
Audio bandwidth	ΔV_o = 3 dB; measured with 50 μs pre-emphasis	B	–	10	–	kHz
AF output voltage (r.m.s. value)	R_L (pin 14) = 100 Ω	$V_{o(rms)}$	–	90	–	mV
AF output current						
max. d.c. load		$I_{o(dc)}$	–100	–	+100	μA
max. a.c. load (peak value)	THD = 10%	$I_{o(ac)}$	–	3	–	mA

Fig.3 Field strength voltage (V_{9-3}) at R_{source} = 1 kΩ; f = 96,75 MHz; V_P = 3 V.

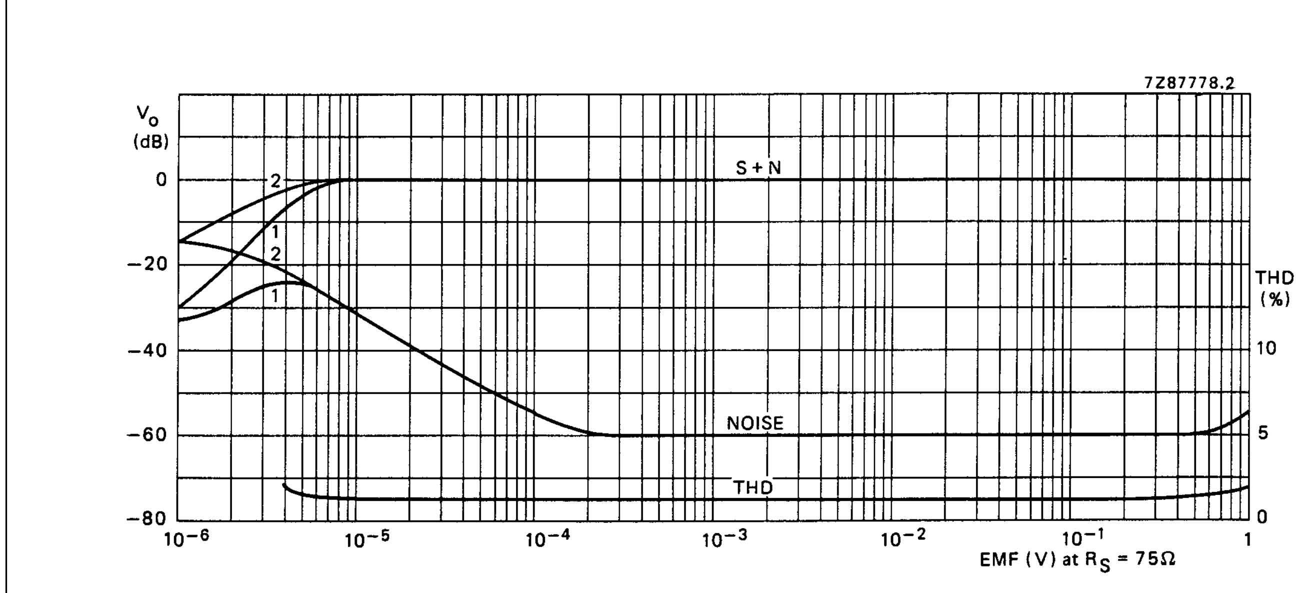
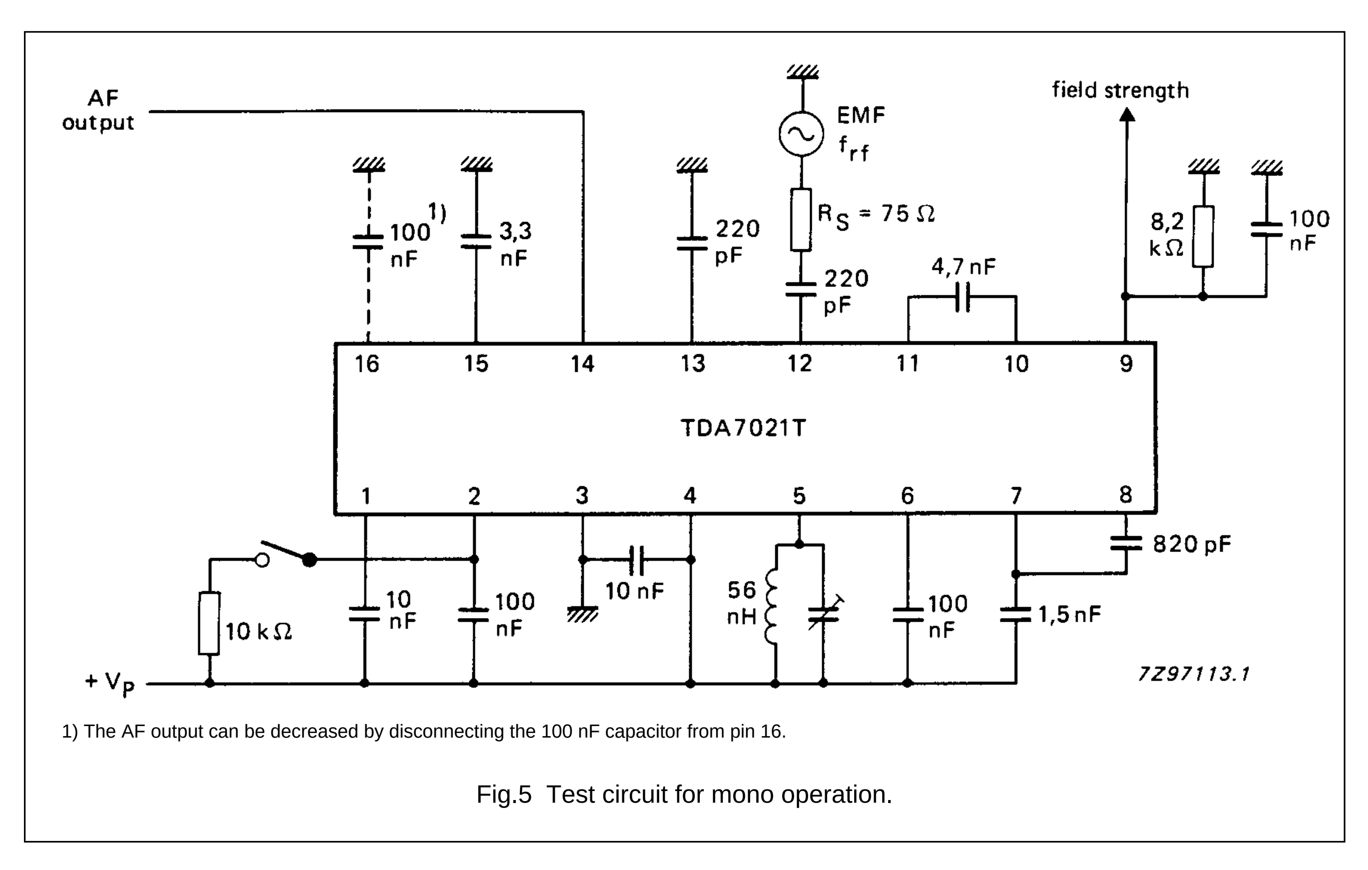


Fig.4 Mono operation: AF output voltage (V_o) and total harmonic distortion (THD) as functions of input e.m.f. (EMF); R_{source} = 75 Ω; f_{rf} = 96 MHz; 0 dB = 90 mV. For S+N and noise curves (1) is with muting enabled and (2) is with muting disabled; signal Δf = ± 22,5 kHz and f_m = 1 kHz. For THD curve, Δf = ± 75 kHz and f_m = 1 kHz.



1) The AF output can be decreased by disconnecting the 100 nF capacitor from pin 16.

Fig.5 Test circuit for mono operation.

AC CHARACTERISTICS (STEREO OPERATION)

V_P = 3 V; T_{amb} = 25 °C; measured in Fig.8; f_{rf} = 96 MHz modulated with pilot Δf = ± 6,75 kHz and AF signal Δf = ±22,5 kHz; f_m = 1 kHz; EMF = 1 mV (e.m.f. at a source impedance of 75 Ω); r.m.s. noise voltage measured unweighted (f = 300 Hz to 20 kHz); unless otherwise specified

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Sensitivity (e.m.f.)						
for (S+N)/N = 26 dB	see Fig.8; pilot off	EMF	–	11	–	μV
Selectivity	see Fig.9; no modulation	S_{+300}	–	40	–	dB
		S_{-300}	–	22	–	dB
Signal-to-noise ratio		(S+N)/N	–	50	–	dB
Channel separation	V_i = L-signal; f_m = 1 kHz; pilot on:					
	at f_{rf} = 97 MHz	α	–	26	–	dB
	at f_{rf} = 87,5 MHz and 108 MHz	α	–	14	–	dB

7Z97590.1

V_o (dB): 0, −10, −20, −30, −40, −50, −60

SEP (dB): 0, 10, 20, 30, 40, 50, 60

EMF (μV): 1, 10, 10^2, 10^3, 10^4

channel separation

signal + noise

stereo noise

mono noise

Fig.6 Stereo operation: signal/noise and channel separation of TDA7021T when used in the circuit of Fig.8.

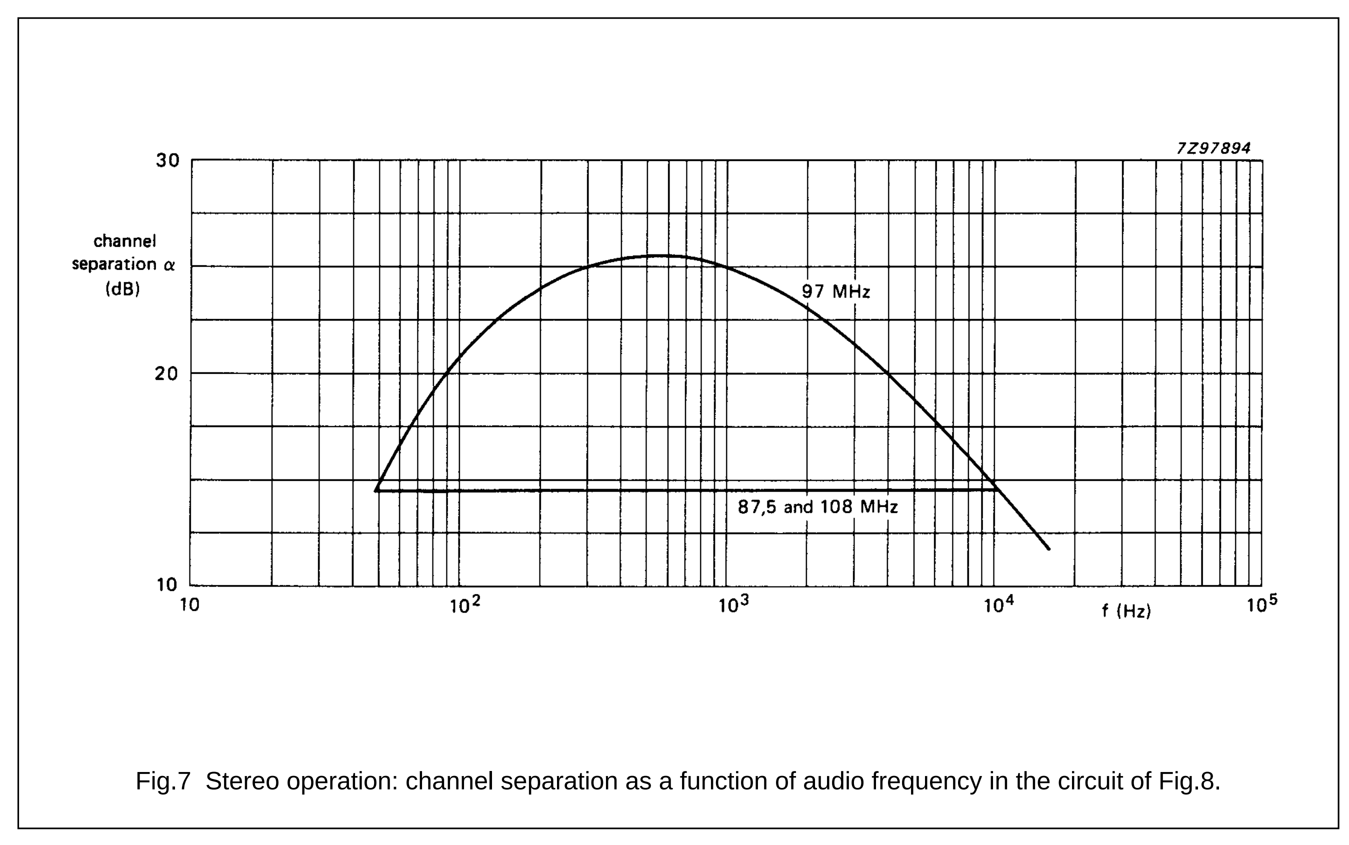


Fig.7 Stereo operation: channel separation as a function of audio frequency in the circuit of Fig.8.

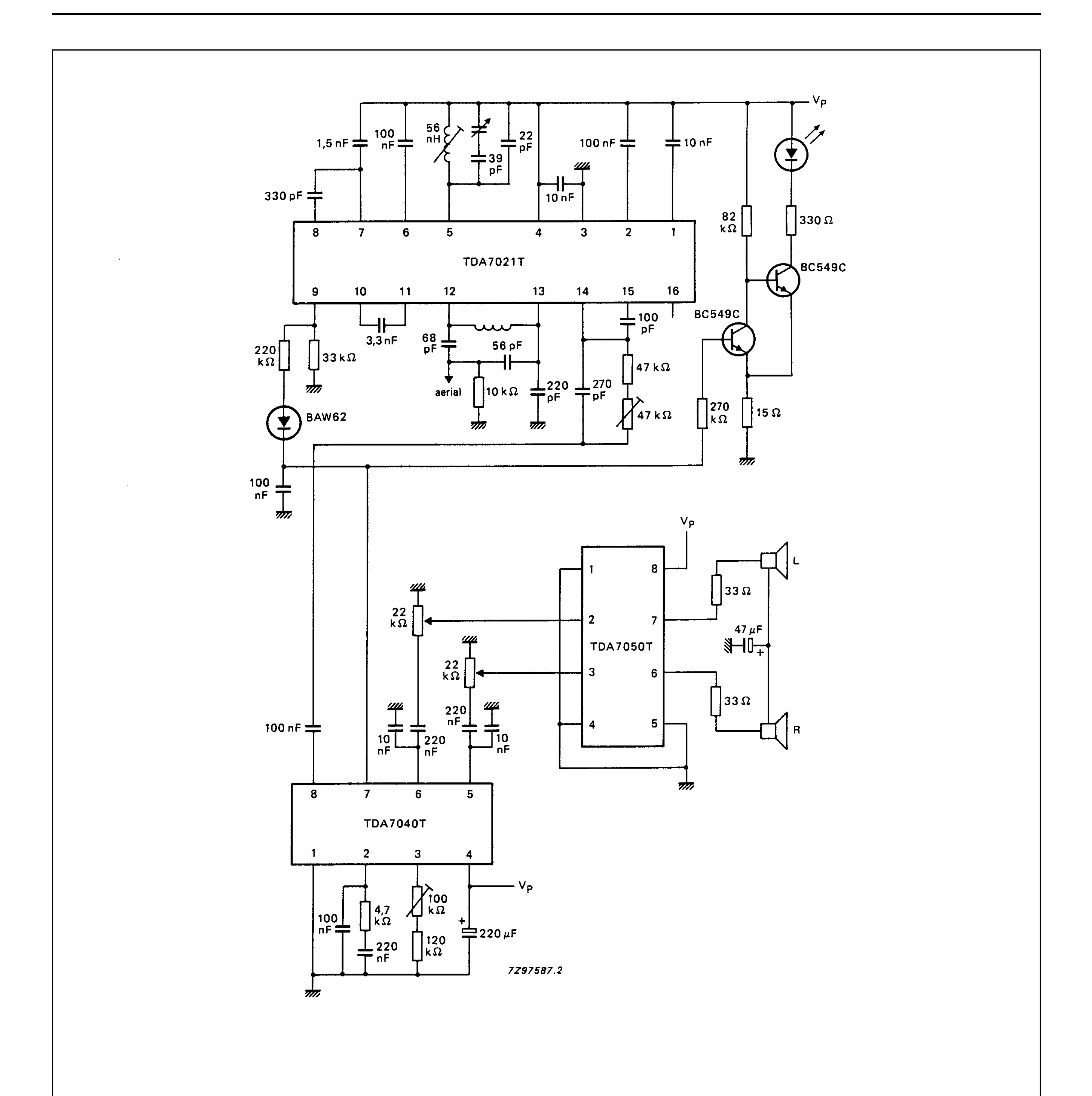


Fig.8 Stereo application in combination with a low voltage PLL stereo decoder (TDA7040T) and a low voltage mono/stereo power amplifier (TDA7050T).

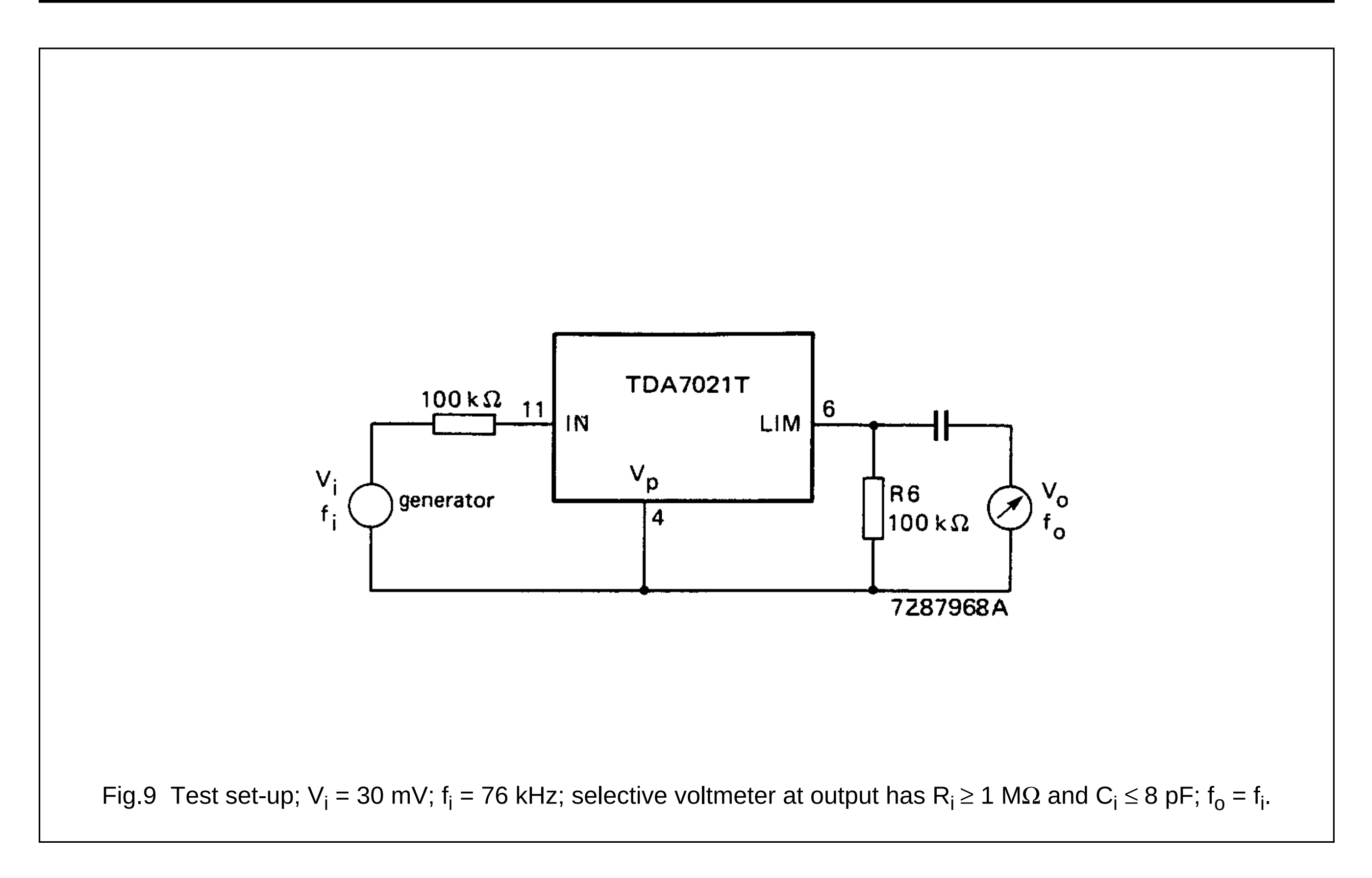


Fig.9 Test set-up; V_i = 30 mV; f_i = 76 kHz; selective voltmeter at output has $R_i \geq 1$ MΩ and $C_i \leq 8$ pF; $f_o = f_i$.

Note to Fig. 9

This test set-up is to incorporate the circuit of Fig.5 for mono operation or the circuit of Fig.8 for stereo operation. For either circuit, replace the 100 nF capacitor at pin 6 with R6 (100 kΩ) as shown above.

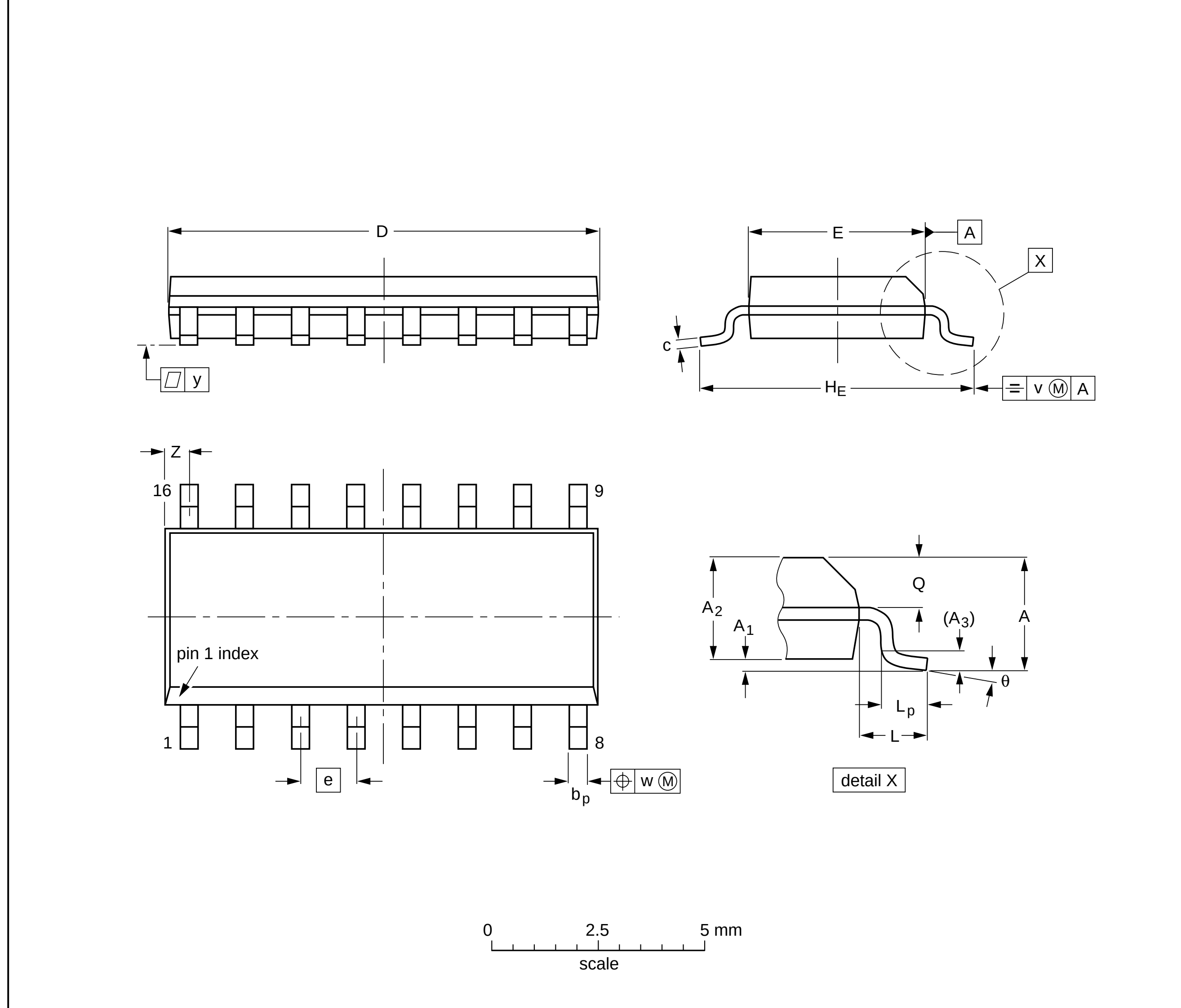
Selectivity

$$S_{+300} = 20 \log \frac{V_o \mid (300 \text{ kHz} - f_i)}{V_o \mid f_i}$$

$$S_{-300} = 20 \log \frac{V_o \mid (300 \text{ kHz} + f_i)}{V_o \mid f_i}$$

PACKAGE OUTLINE

SO16: plastic small outline package; 16 leads; body width 3.9 mm **SOT109-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8^o 0^o
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.39 0.38	0.16 0.15	0.050	0.244 0.228	0.041	0.039 0.016	0.028 0.020	0.01	0.01	0.004	0.028 0.012	

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT109-1	076E07S	MS-012AC				~~95-01-23~~ 97-05-22

SOLDERING

Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"IC Package Databook"* (order code 9398 652 90011).

Reflow soldering

Reflow soldering techniques are suitable for all SO packages.

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several techniques exist for reflowing; for example, thermal conduction by heated belt. Dwell times vary between 50 and 300 seconds depending on heating method. Typical reflow temperatures range from 215 to 250 °C.

Preheating is necessary to dry the paste and evaporate the binding agent. Preheating duration: 45 minutes at 45 °C.

Wave soldering

Wave soldering techniques can be used for all SO packages if the following conditions are observed:

- A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.
- The longitudinal axis of the package footprint must be parallel to the solder flow.
- The package footprint must incorporate solder thieves at the downstream end.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Maximum permissible solder temperature is 260 °C, and maximum duration of package immersion in solder is 10 seconds, if cooled to less than 150 °C within 6 seconds. Typical dwell time is 4 seconds at 250 °C.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

Repairing soldered joints

Fix the component by first soldering two diagonally-opposite end leads. Use only a low voltage soldering iron (less than 24 V) applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C. When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

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